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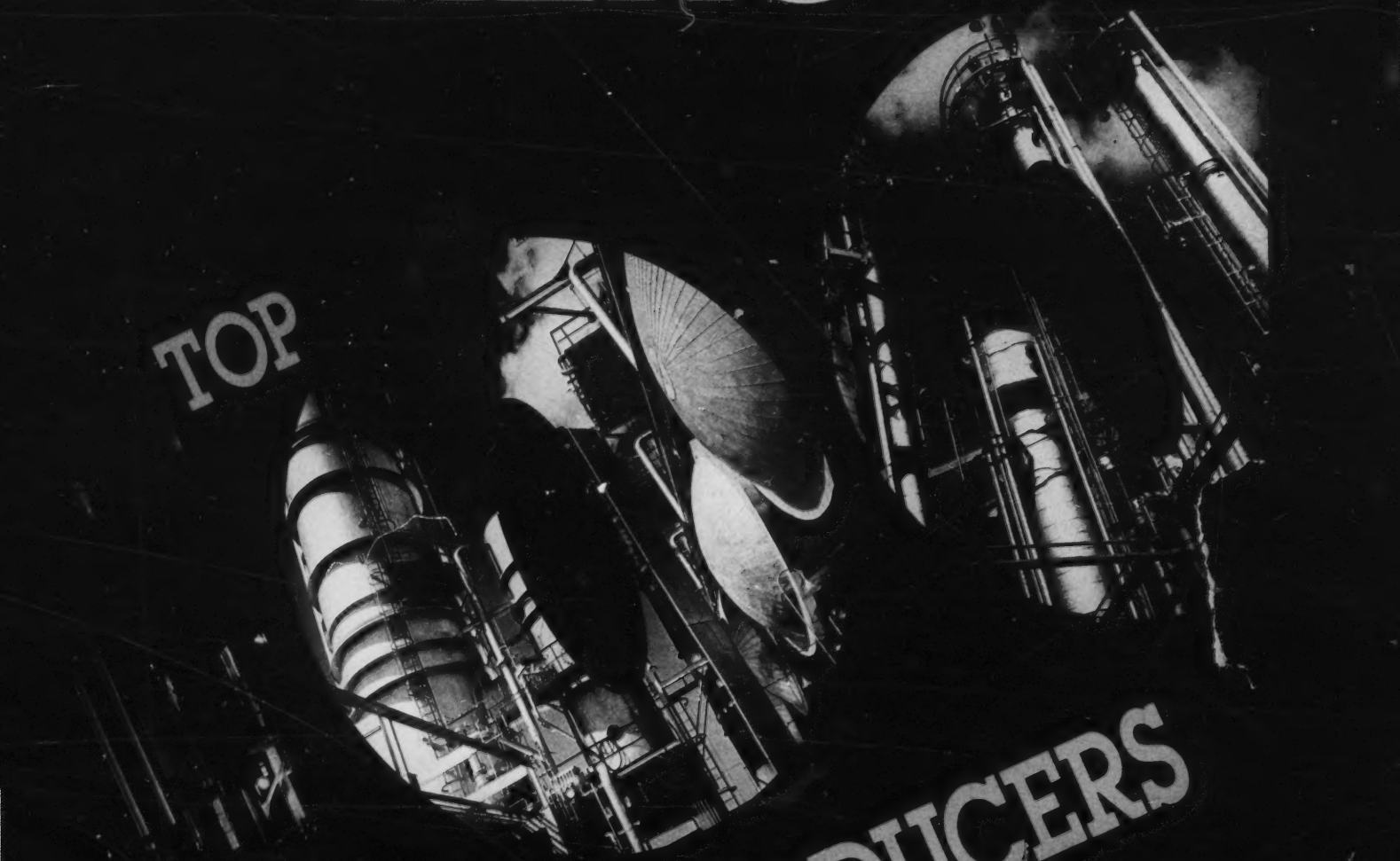
More scientific news from Atlanta ACS meeting

MAY 6, 1991

CHEMICAL & ENGINEERING

NEWS



TOP CHEMICAL PRODUCERS

PAGE 11

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News of the Week

■ **Federal agency science funding should double in the 1990s, urged NAS president Frank Press at the academy's annual meeting.** Page 6

■ **Costs of complying with future environmental regulations could seriously hurt credit ratings of companies, warns report from Moody's Investors Service.** Page 7

■ **Chicago company and five executives acquitted of criminal charges of damaging workers' health by exposing them to toxic chemicals.** Page 7

■ **NASA rolled out its new upgraded space shuttle, *Endeavour*, giving the agency four operational shuttles for the first time since the loss of *Challenger* in 1986.** Page 7

■ **Duty-free treatment will end for imports of ibuprofen from India, giving boost to Ethyl Corp., sole U.S. producer of the analgesic and anti-inflammatory drug.** Page 8

■ **A number of chemists are among the 60 new members and 15 foreign associates elected to the National Academy of Sciences.** Page 8

Business

OSHA-sponsored study of safety issues related to contract worker use in the petrochemical industry may lead to significant policy changes; commercialization of growth hormone that boosts milk output in cows is held up by negative public reaction, extended FDA review. **Page 23**

Government

What constitutes discrimination and harassment in the workplace and what workers face if they file charges was topic of major symposium at the Atlanta meeting; recent environment report is used by President Bush as evidence of his Administration's strong progress in this area last year. **Page 27**

Science/Technology

From the Atlanta meeting: Mechanism of action of anticancer drugs that modify DNA is becoming clearer, offering hope for design of more effective, less toxic drugs; more rational approaches to drug discovery from natural products described; analytical chemists make progress in characterizing large molecules; new study validates Dalton's data; globalization of R&D backed by Japanese executives; California researchers propose new strategy for optimizing optical nonlinearity; EPA study finds pesticides, nitrates in U.S. wells; infant/toddler exposure to household pesticide hazards measured; researchers offer new insight to metal-heteroatom bond chemistry; need for building electric power demonstration plants questioned; gas separation research yields new membrane materials, uses; modeling software for polymers, general uses unveiled. **Page 31**

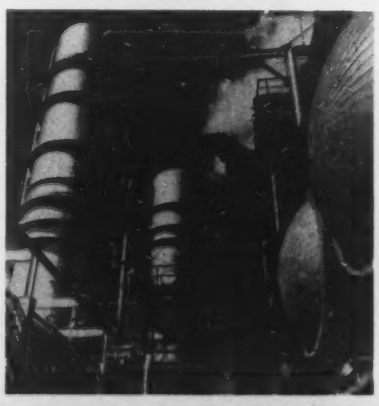
ACS News

ACS Council boosted dues for 1992, adopted one petition, defeated another, among other actions at meeting in Atlanta last month. **Page 60**

Letters 4

Concentrates
Business 21
Government 26
Science/Technology 30

The Departments
New Products 49
Books 57
Meetings 64
Newscripts 84



News Focus

Combined sales of the 100 largest U.S. chemical producers posted another record in 1990, up 5% over 1989 to $185 billion; profits, however, fell for most companies. Page 11

Chemical & Engineering News
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LETTERS

RU-486 controversy

Rudy Baum's article on RU-486 (C&EN, March 11, page 7) was very informative and interesting, but revealed an ethical position that concerns me. The overriding impression coming from the researchers interviewed was that "RU-486 exists, therefore I should be allowed to use it." But should knowledge be pursued just because the means are available? I believe that ethical concerns should be considered.

The introduction basically claims that since abortion is legal, access to this drug should be unaffected by the abortion debate. However, the legality of an issue does not determine its morality, as was seen in Nazi Germany when human experimentation was legally allowed—but few will consider that it was morally right. Regardless of the legality of abortion, or one's personal stand on the issue, the fact is that use of this drug involves ethics, and ethical discussion on RU-486 would be advisable. The quotations from the American Association for the Advancement of Science meeting on RU-486 do not give the impression that the goal was to discuss the ethics of RU-486, but rather to demand its availability.

Roussel-Uclaf's caution in supplying the drug unconditionally is to be commended, even if this is more for image's sake than for purely ethical reasons. On a different point, it is of note that Ariel Mouttet of Roussel-Uclaf states that the U.S. fails her company's criteria on two points, and yet no further mention is made of the lack of a synthetic prostaglandin in the remainder of the article.

If science is to remain truly human we must give ethical considerations in research an adequate hearing. My hope is that ethical concerns will not be dismissed simply because they are ethical and may adversely affect our research goals.

Donal O'Mathuna
Visiting Assistant Professor of Chemistry
Capital University and Mt. Carmel
College of Nursing
Columbus, Ohio

Rudy Baum's article brings to focus many of the issues surrounding this important steroid analog. Baum rightly alludes to the highly charged emotions and politics that befall not only RU-486, but all matters dealing with abortion in the U.S.

With a well-educated and critical audience that is particularly well suited to comprehend the chemical implications of RU-486, Baum had the opportunity to present the facts surrounding RU-486 in an unembellished and straightforward manner. It was disappointing, therefore, to see him trivialize opposition toward introduction of RU-486 into the U.S. by those who oppose its potential use as an abortifacient. In establishing the background for this approach, Baum characterized abortion as widely accepted in American society, while making no distinction in the fundamental difference between a society that accepts abortion in and of itself and one that recognizes the established judicial right of a woman to have such a procedure.

The lack of such a distinction, coupled with an imbalanced and less than flattering portrayal of RU-486 opponents, leads one to conclude that impediments to the introduction of this drug into the U.S. are due chiefly to a small number of simple-minded zealots who do not reflect the interests of society at large. This biasing detracts from an article that otherwise contains useful information, and that provides a valuable service by bringing to scrutiny the potential benefits of RU-486 for a variety of noncontroversial uses.

Terrence R. Burke Jr.
Bethesda, Md.

Accuracy of Superfund samples

It is with a feeling of disbelief that I write this response to the article, "Contract Labs Charged with Fraud in Analyses of Superfund Samples" (C&EN, Feb. 25, page 14). In the past I have managed such an Environmental Protection Agency-sponsored program and thus was filled with dismay to read that the 10-day sample storage has no scientific basis. The other equally disappointing statement in this article contains the phrase, "determine roughly what is in the complex waste samples and about how much."

I am under the impression that sample storage deadlines adopted for Superfund are from the *Federal Register*, which is printed as a result of an act of Congress. The statement of work of the program explicitly states that generated analytical data be quantitative in nature and also be legally defensible. I wonder about the utility of the Superfund program as such, particularly because now we all know that its protocols include sample storage constraints based purely on avoiding the piling of the samples at labs, and on the quality of analytical results that represent only rough determinations.

Top 100 Chemical Producers Post Overall Sales Improvement

1990 was another record year with total sales up 5%; sales fell for 36 firms, however, and chemical operating profits suffered at most companies

William J. Storck,
C&EN Northeast News Bureau

Last year was not the worst 12 months for the U.S. chemical industry, but it was a year that brought many problems for chemical producers already weakened during much of 1989 and the first part of 1990. In the second half of 1990, the industry ran up against sagging demand in many sectors in both U.S. and foreign markets. And it was hard hit by increasing raw material costs.

The result was declining profits and profitability. However, in spite of the problems, the industry managed to increase sales during 1990. And the sales dollar increase was not all attributable to inflation. In spite of everything, there was a small amount of physical volume growth.

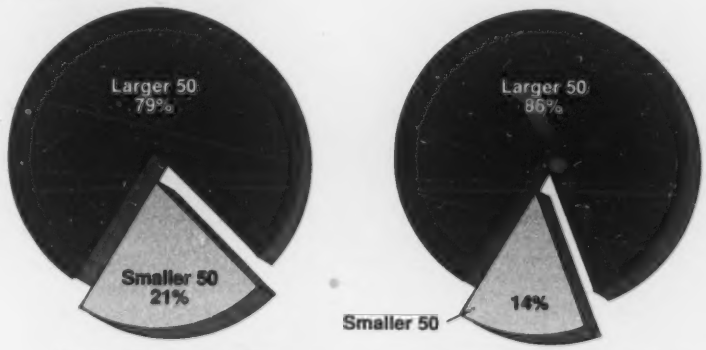
To put the relative importance of the companies comprising C&EN's annual ranking of the Top 100 chemical producers into perspective, their aggregate sales of chemicals accounted for almost 70% of the value of U.S. shipments of chemicals and allied products last year. And their chemical sales made up more than 6% of shipments of all U.S. manufacturing industries in 1990.

The increasing dollar volume is reflected among the companies included in the Top 100. Sales for the chemical companies in the 1990 ranking increased about 5% over 1989 to about $185 billion. There was some attrition among the larger firms in 1990 (for instance, BP America is no longer on the list), but sales for the 100 chemical-producing companies listed were up an average of more than 2% over the companies in the 1989 ranking.

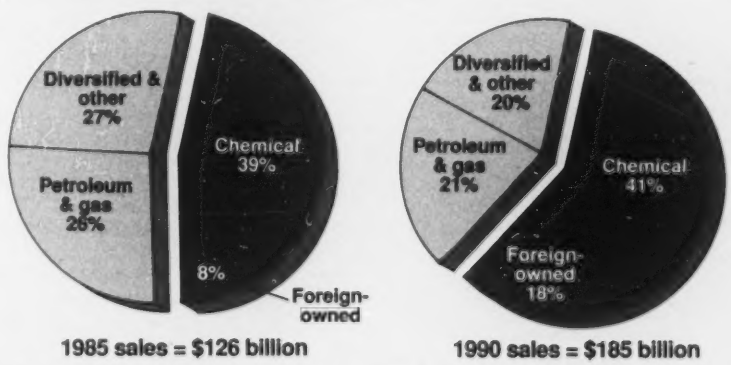
In spite of the increase in total chemical sales for the 100 companies, not all were in the plus column. In fact, 36 of the companies registered declines in chemical sales for 1990 compared with 1989. Of the remaining companies, 60 had higher chemical sales last year than the year before, and the remaining four either recorded no change or comparable 1989 figures were not available.

The contributions of the different categories of companies to total sales remained relatively constant for 1990. The 50 largest companies continued to more than dominate the

In past five years, larger companies have increased their dominance . . .



. . . and chemical and foreign-owned companies have taken bigger share of sales



Note: Based on chemical sales figures for Top 100 producers in 1985 and 1990.

Sales of the Top 100 chemical companies totaled about $185 billion in 1990

Rank 1990	Rank 1989		Chemical sales 1990 ($ millions)	Change from 1989	Chemical sales as % of total sales	Industry classification	Chemical operating profits[a] ($ millions)	Change from 1989	Chemical operating profits as % of total profits	Operating profit margin[b]	Identifiable chemical assets ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
1	1	Du Pont	$15,571	2.1%	38.9%	Diversified	$1968	−28.9%	40.1%	12.6%	$13,788	36.2%	14.3%
2	2	Dow Chemical	14,690	3.6	74.3	Basic chemicals	1925	−45.7	68.3	13.1	13,604	56.8	14.2
3	3	Exxon	11,153	5.6	9.6	Petroleum	737	−54.1	8.1	6.6	8,548	9.7	8.6
4	4	Union Carbide	7,621[d]	−0.4	100.0	Basic chemicals	1033	−17.0	100.0	13.6	7,613	87.2	13.6
5	5	Monsanto	5,711	−1.2	63.5	Basic chemicals	624	−32.8	68.6	10.9	4,831	52.3	12.9
6	6	Hoechst Celanese	5,499	−2.8	93.5	Basic chemicals	427	−25.9	105.4	7.8	na	na	na
7	8	General Electric	5,167[d]	4.8	8.8	Diversified	1017	−3.8	13.2	19.7	7,973	5.2	12.8
8	7	Occidental Petroleum	5,040	−2.4	23.2	Petroleum	636	−39.8	23.4	12.6	5,494	27.8	11.6
9	9	BASF	4,366	−2.1	81.1	Basic chemicals	na	na	na	na	na	na	na
10	10	Amoco	4,087	−4.4	12.9	Petroleum	252	−66.1	6.4	6.2	3,646	11.5	6.9
11	11	Mobil	4,084	1.1	7.7	Petroleum	397	−47.1	7.6	9.7	3,265	7.8	12.2
12	12	Shell Oil	3,718	−3.0	15.2	Petroleum	519	−44.8	26.6	14.0	3,952	13.9	13.1
13	13	Eastman Kodak	3,588	1.9	19.0	Photo equipment	602	−6.4	21.2	16.8	3,952	16.4	15.2
14	15	W. R. Grace	3,570	10.8	52.9	Specialty chemicals	431	6.9	77.9	12.1	2,756	44.3	15.6
15	14	Chevron	3,325	9.1	8.0	Petroleum	44	−91.7	0.9	1.3	2,622	7.5	1.7
16	17	Arco Chemical	2,830	6.3	100.0	Basic chemicals	469	−19.1	100.0	16.6	3,739	100.0	12.5
17	18	Rohm & Haas	2,824	6.1	100.0	Basic chemicals	351	22.3	100.0	12.4	2,414	100.0	14.5
18	16	Allied-Signal	2,786	−6.9	22.6	Diversified	287	−19.2	39.3	10.3	1,896	18.1	15.1
19	19	Air Products[e]	2,614	5.3	90.3	Basic chemicals	441	3.6	108.0	16.9	3,132	80.3	14.1
20	21	Bayer USA	2,380	3.6	40.0	Diversified chemicals	91[f]	−24.9	61.2	3.8[f]	na	na	na
21	32	Rhône-Poulenc	2,278	42.4	100.0	Specialty chemicals	na	na	na	na	na	na	na
22	22	American Cyanamid	2,255	0.6	49.3	Basic chemicals	195	−15.0	62.2	8.7	1,832	36.0	10.7
23	23	Ashland Oil[e]	2,245	0.7	25.0	Petroleum	70	−45.3	21.1	3.1	856	16.7	8.2
24	30	Hercules	2,193	3.6	68.5	Basic chemicals	167	22.8	69.0	7.6	1,860	50.3	9.0
25	20	Phillips Petroleum	2,120	−13.4	15.6	Petroleum	448	−31.3	21.3	21.1	1,797	14.8	24.9
26	42	Ciba-Geigy	1,976	10.0	52.0	Specialty chemicals	na	na	na	na	na	na	na
27	24	Quantum Chemical	1,959	−6.9	73.8	Basic chemicals	242	−42.7	95.1	12.4	2,235	69.4	10.8
28	25	B. F. Goodrich	1,940	−1.9	79.7	Basic chemicals	129	−50.4	85.2	6.7	1,521	64.3	8.5
29	31	Akzo	1,893	1.0	100.0	Basic chemicals	152	11.6	100.0	8.0	na	na	na
30	26	Lyondell Petrochemical	1,889	19.6	29.1	Petroleum products	na	na	na	na	na	na	na
31	29	Alcoa	1,842[d]	5.7	17.2	Nonferrous metals	1319	11.5	121.3	71.6	2,855	25.0	46.2
32	27	Texaco	1,723	−5.2	4.1	Petroleum	60	−85.0	2.5	3.5	1,308	5.0	4.6
33	33	Dow Corning	1,718	9.1	100.0	Specialty chemicals	171[f]	5.1	100.0	10.0[f]	na	na	na
34	34	National Starch	1,670	6.4	100.0	Specialty chemicals	254	12.3	100.0	15.2	1,448	100.0	17.6
35	35	FMC	1,624	5.4	43.6	Machinery	192	−15.1	45.4	11.8	1,469	49.6	13.0
36	36	Ethyl	1,591	4.7	100.0	Basic chemicals	308	9.0	100.0	19.4	1,383	100.0	22.3
37	28	±Atochem	1,540	−13.4	100.0	Basic chemicals	na	na	na	na	na	na	na
38	56	Degussa	1,435	61.9	75.3	Specialty chemicals	na	na	na	na	na	na	na
39	45	Lubrizol	1,335	18.6	91.9	Specialty chemicals	398	24.1	90.8	29.8	887	79.5	44.9
40	42	Huntsman Chemical	1,300	8.3	100.0	Basic chemicals	na	na	na	na	na	na	na
41	40	Tenneco	1,298	6.0	8.9	Diversified	167	40.3	11.5	12.9	1,409	7.5	11.9
42	38	Olin	1,269	−1.2	49.0	Basic chemicals	45	−74.1	30.6	3.5	945	50.6	4.8
43	39	Unocal	1,236	−3.1	10.5	Petroleum	115	−47.0	23.7	9.3	671	6.9	17.1
44	48	Nalco Chemical	1,212	13.2	100.0	Specialty chemicals	211	16.3	100.0	17.4	1,037	100.0	20.3
45	44	PPG Industries	1,150	−2.1	19.1	Glass products	231	−10.1	25.4	20.1	1,076	17.6	21.5
46	52	Cabot[e]	1,107	16.3	66.2	Basic chemicals	147	32.1	89.6	13.3	1,100	63.5	13.4
47	41	IMC Fertilizer[g]	1,106	−9.5	100.0	Agrochemicals	171	−33.5	100.0	15.5	1,585	100.0	10.8
48	61	Great Lakes Chemical	1,066	34.6	100.0	Specialty chemicals	290	43.7	100.0	27.2	1,406	100.0	20.6
49	67	Imcera[g]	1,025	54.7	71.9	Specialty chemicals	104	99.2	92.5	10.2	1,090	51.1	9.6
50	54	Morton International[g]	1,021	9.2	62.3	Specialty chemicals	140	−3.4	58.0	13.7	na	na	na

Rank 1990	Rank 1989		Chemical sales 1990 ($-millions)	Change from 1989	Chemical sales as % of total sales	Industry classification	Chemical operating profits[a] ($ millions)	Change from 1989	Chemical operating profits as % of total profits	Operating profit margin[b]	Identifiable chemical assets ($ millions)	Chemical assets as % of total assets	Operating return on chemical assets[c]
51	—	Reichhold Chemicals	$1000	na	100.0%	Specialty chemicals	na	na	na	na	na	na	na
52	50	Solvay America	997	0%	100.0	Basic chemicals	na	na	na	na	na	na	na
53	51	Aristech	974	−2.2	100.0	Basic chemicals	na	na	na	na	na	na	na
54	55	Farmland Industries[h]	965	9.2	28.6	Agricultural supplies	$84	−7.0%	52.5%	8.7%	$412	30.4%	20.4%
55	57	International Flavors	963	10.7	100.0	Specialty chemicals	243	11.8	100.0	25.3	1129	100.0	21.5
56	53	Terra Chemicals	961	1.3	100.0	Agrochemicals	na	na	na	na	na	na	na
57	47	Georgia Gulf	932	−15.6	100.0	Basic chemicals	229	−23.6	100.0	24.5	457	100.0	50.1
58	49	NL Industries	907	−9.4	100.0	Basic chemicals	251	−18.6	100.0	27.7	1967	100.0	12.8
59	58	CF Industries	903	5.5	100.0	Agrochemicals	49	78.5	100.0	5.4	801	100.0	6.1
60	46	Freeport-McMoRan	825	−25.3	52.2	Agrochemicals	52	−52.3	17.2	6.3	880	24.5	5.9
61	66	American Petrofina	813	22.8	21.1	Petroleum	160	15.7	61.8	19.7	523	18.4	30.6
62	60	Uniroyal Chemical	808	0.4	100.0	Specialty chemicals	108	2.4	100.0	13.4	1178	100.0	9.2
63	59	Engelhard	807	−0.7	27.4	Diversified	100	3.8	71.0	12.4	874	66.2	11.4
64	65	H. B. Fuller[i]	792	5.2	100.0	Specialty chemicals	52	12.8	100.0	6.6	490	100.0	10.6
65	64	Witco	769[j]	0.4	47.1	Specialty chemicals	82	363.7	66.9	10.7	477	40.5	17.2
66	62	Vista Chemicals[e]	719	−7.7	100.0	Basic chemicals	151	−32.7	100.0	20.9	na	na	na
67	69	Kerr-McGee	642	8.4	17.4	Petroleum	123	−1.6	33.8	19.2	658	18.9	18.7
68	72	Betz Laboratories	597	15.5	100.0	Specialty chemicals	104	19.0	100.0	17.4	427	100.0	24.4
69	79	Loctite	555	17.2	100.0	Specialty chemicals	48	17.0	100.0	8.6	489	100.0	9.7
70	76	Merck	551	11.9	7.2	Drugs	68	14.5	2.6	12.3	510	6.4	13.3
71	74	Pfizer	548	7.5	8.5	Drugs	29	−26.2	2.5	5.3	418	4.6	6.9
72	77	Ferro	513	5.5	45.6	Specialty materials	10	−48.2	14.5	2.0	288	42.0	3.5
73	70	Sterling Chemical[e]	506	−12.9	100.0	Basic chemicals	88	−43.4	100.0	17.5	352	100.0	25.1
74	75	Hoffmann-La Roche	500	0	20.8	Drugs	na	na	na	na	na	na	na
75	63	Nova	489	−27.9	100.0	Basic chemicals	−17	def	100.0	def	221	100.0	def
76	73	Sun Co.	486	−4.6	3.7	Petroleum	na	na	na	na	na	na	na
77	68	GAF	481	−19.8	52.2	Specialty chemicals	164	−4.4	88.8	34.0	na	na	na
78	—	Hüls	465	3.6	100.0	Specialty chemicals	na	na	na	na	na	na	na
79	83	Union Camp	460	12.8	16.2	Diversified	22	66.2	6.1	4.9	352	8.0	6.4
80	84	Sigma-Aldrich	440	22.6	83.2	Specialty chemicals	104	14.3	94.1	23.5	485	88.7	21.4
81	81	Dexter	438	−0.1	48.3	Specialty chemicals	38	23.3	90.7	8.7	280	36.7	13.7
82	78	Borden Chemicals	421	−9.7	100.0	Basic chemicals	68	−29.1	100.0	16.1	544	100.0	12.4
83	82	Vulcan Materials	409	−4.9	37.0	Nonmetallic minerals	72	−16.2	39.3	17.7	na	na	na
84	85	Stepan	390	12.5	100.0	Specialty chemicals	21	83.1	100.0	5.5	247	100.0	8.7
85	87	Crompton & Knowles	311	10.7	79.7	Specialty chemicals	43	19.6	72.2	13.9	239	84.5	18.1
86	86	First Mississippi[g]	295	−4.1	59.3	Agrochemicals	23	−14.8	97.4	7.8	173	33.9	13.3
87	90	Calgon Carbon	285	12.4	100.0	Basic chemicals	62	10.1	100.0	21.9	285	100.0	21.9
88	89	Petrolite[k]	283	2.9	94.2	Specialty chemicals	17	−9.4	93.3	5.9	209	82.8	8.0
89	88	Chemed	275	−0.9	45.9	Specialty chemicals	23	−38.6	56.3	8.5	139	42.4	16.9
90	92	Mississippi Chemical[g]	253	21.1	100.0	Farm cooperative	5	−89.6	100.0	1.9	289	100.0	1.7
91	90	Georgia-Pacific	247	−2.4	2.0	Wood products	na	na	na	na	na	na	na
92	94	Quaker Chemical	201	10.9	100.0	Specialty chemicals	22	17.6	100.0	10.7	152	100.0	14.1
93	—	Sequa Corp.	201	42.4	10.8	Diversified	30	54.4	20.2	14.7	112	5.9	26.5
94	93	Sherex	177	−5.9	100.0	Specialty chemicals	na	na	na	na	na	na	na
95	98	Lawter International	150	10.3	100.0	Specialty chemicals	28	23.0	100.0	18.5	154	100.0	18.0
96	95	LeaRonal[l]	141	−10.5	100.0	Specialty chemicals	14	−10.4	100.0	10.0	81	100.0	17.3
97	99	Cambrex Corp.	134	2.0	100.0	Specialty chemicals	4	−32.3	100.0	3.3	na	na	na
98	97	Eagle-Picher	123	−19.4	17.5	Diversified	16	7.4	33.3	13.0	76	18.2	21.1
99	—	Aceto[g]	122	8.1	100.0	Specialty chemicals	7	−2.4	100.0	5.4	68	100.0	9.6
100	—	Sybron	120	na	100.0	Specialty chemicals	na	na	na	na	na	na	na

a Operating income is sales less administrative expenses and cost of sales. b Chemical operating profit as a percentage of sales. c Chemical operating profit as a percentage of identifiable chemical assets. d Chemical sales include significant amounts of nonchemical products. e Fiscal year ended Sept. 30. f Chemical net income. g Fiscal year ended June 30. h Fiscal year ended Aug. 31. i Fiscal year ended Nov. 30. j Does not include all chemical sales. k Fiscal year ended Oct. 31. l Fiscal year ended Feb. 28, 1990.

C&EN's five-way ranking of the Top 100 chemical producers

	Chemical sales			Chemical operating profits			Chemical operating profit margin			Identifiable chemical assets			Return on chemical assets		
		Rank			Rank			Rank			Rank			Rank	
$ Millions	1990	1990	1989	1990	1990	1989	1990	1990	1989	1990	1990	1989	1990	1990	1989
Aceto	$ 122	99	—	$ 7	78	—	5.4%	70	—	$ 68	74	—	9.6%	55	—
Air Products	2,614	19	19	441	13	16	16.9	22	32	3,132	13	11	14.1	33	49
Akzo	1,893	29	31	152	37	45	8.0	59	66	na	—	—	na	—	—
Alcoa	1,842	31	29	1319	3	—	71.6	1	—	2,855	14	—	46.2	2	—
Allied-Signal	2,786	18	16	287	21	20	10.3	49	51	1,896	20	18	15.1	28	34
American Cyanamid	2,255	22	22	195	30	29	8.7	54	55	1,832	22	20	10.7	52	52
American Petrofina	813	61	66	160	36	41	19.7	13	23	523	47	53	30.6	4	8
Amoco	4,087	10	10	252	23	10	6.2	67	31	3,646	11	10	6.9	64	17
Arco Chemical	2,830	16	17	469	11	13	16.6	24	18	3,739	10	13	12.5	44	24
Aristech	974	53	51	na	—	40	na	—	43	na	—	42	na	—	32
Ashland Oil	2,245	23	23	70	53	48	3.1	77	73	856	42	40	8.2	62	52
Atochem	1,540	37	28	na	—	—	na	—	—	na	—	—	na	—	—
BASF	4,366	9	9	na	—	—	na	—	—	na	—	—	na	—	—
Bayer USA	2,380	20	21	na	—	—	na	—	—	na	—	—	na	—	—
Betz Laboratories	597	68	72	104	45	52	17.4	20	33	427	54	57	24.4	8	16
Borden Chemicals	421	82	78	68	54	50	16.1	25	24	544	46	48	12.4	45	40
Cabot	1,107	46	52	147	39	46	13.3	34	53	1,100	34	39	13.4	36	50
Calgon Carbon	285	87	90	62	56	59	21.9	9	15	285	61	63	21.9	10	15
Cambrex Corp.	134	97	99	4	80	78	3.3	76	71	na	—	71	na	—	69
CF Industries	903	59	58	49	60	67	5.4	70	77	801	43	37	6.1	67	72
Chemed	275	89	88	23	69	64	8.5	58	44	139	70	69	16.9	25	11
Chevron	3,325	15	14	44	63	15	1.3	80	37	2,622	16	15	1.7	73	25
Ciba-Geigy	1,976	26	42	na	—	—	na	—	—	na	—	—	na	—	—
Crompton & Knowles	311	85	87	43	64	65	13.9	30	47	239	64	66	18.1	19	26
Degussa	1,435	38	56	na	—	—	na	—	—	na	—	—	na	—	—
Dexter	438	81	81	38	65	66	8.7	54	67	280	62	60	13.7	34	59
Dow Chemical	14,690	2	2	1925	2	1	13.1	35	10	13,604	2	2	14.2	31	9
Dow Corning	1,718	33	33	na	—	—	na	—	—	na	—	—	na	—	—
Du Pont	15,571	1	1	1968	1	2	12.6	38	29	13,788	1	1	14.3	30	22
Eagle-Picher	123	98	97	16	75	75	13.0	36	60	76	73	74	21.1	14	40
Eastman Kodak	3,588	13	13	602	9	12	16.8	23	28	3,952	8	9	15.2	27	30
Engelhard	807	63	59	100	48	59	12.4	40	52	874	41	34	11.4	49	58
Ethyl	1,591	36	36	308	19	24	19.4	15	27	1,383	30	30	22.3	9	12
Exxon	11,153	3	3	737	6	3	6.6	64	40	8,548	3	4	8.6	60	20
Farmland Industries	965	54	55	84	50	51	8.7	54	58	412	56	55	20.4	16	17
Ferro	513	72	77	10	77	73	2.0	78	74	288	60	62	3.5	71	67
First Mississippi	295	86	86	23	69	67	7.8	60	62	173	67	68	13.3	38	46
FMC	1,624	35	35	192	31	33	11.8	45	42	1,469	26	24	13.0	40	45
Freeport-McMoRan	825	60	46	52	58	47	6.3	66	59	880	40	35	5.9	68	56
H. B. Fuller	792	64	65	52	58	62	6.6	64	69	490	49	52	10.6	53	59
GAF	481	77	68	164	35	37	34.0	2	3	na	—	—	na	—	—
General Electric	5,167	7	8	1017	5	6	19.7	13	19	7,973	4	3	12.8	43	52
Georgia Gulf	932	57	47	229	28	22	24.5	7	5	457	53	50	50.1	1	1
Georgia-Pacific	247	91	90	na	—	—	na	—	—	na	—	—	na	—	—
B. F. Goodrich	1,940	28	25	129	41	26	6.7	63	46	1,521	25	22	8.5	61	38
W. R. Grace	3,570	14	15	431	14	18	12.1	44	49	2,756	15	16	15.6	26	44
Great Lakes Chemical	1,066	48	61	290	20	34	27.2	5	9	1,406	29	29	20.6	15	36
Hercules	2,193	24	30	167	33	42	7.6	62	64	1,860	21	25	9.0	58	61
Hoechst Celanese	5,499	6	6	427	15	14	7.8	60	57	na	—	—	na	—	—
Hoffmann-La Roche	500	74	75	na	—	—	na	—	—	na	—	—	na	—	—

	Chemical sales			Chemical operating profits			Chemical operating profit margin			Identifiable chemical assets			Return on chemical assets		
		Rank			Rank			Rank			Rank			Rank	
$ Millions	1990	1990	1989	1990	1990	1989	1990	1990	1989	1990	1990	1989	1990	1990	1989
Hüls	$ 465	78	—	na	—	—	na	—	—	na	—	—	na	—	—
Huntsman Chemical	1300	40	42	na	—	—	na	—	—	na	—	—	na	—	—
IMC Fertilizer	1106	47	41	$ 171	32	27	15.5%	26	20	$1585	24	21	10.8%	51	48
Imcera	1025	49	67	104	45	60	10.2	50	63	1090	35	44	9.6	56	65
International Flavors	983	55	57	243	25	32	25.3	6	8	1129	33	43	21.5	11	7
Kerr-McGee	642	67	69	123	42	43	19.2	16	20	658	45	38	18.7	18	47
Lawter International	150	95	98	28	68	69	18.5	17	35	154	68	70	18.0	20	42
LeaRonal	141	96	95	14	76	74	10.0	51	56	81	72	73	17.3	22	37
Loctite	555	69	79	48	61	55	8.8	57	30	489	50	58	9.7	54	23
Lubrizol	1335	39	45	398	16	21	29.8	3	2	887	39	41	44.9	3	4
Lyondell Petrochemical	1889	30	26	na	—	—	na	—	—	na	—	—	na	—	—
Merck	551	70	76	68	54	58	12.3	43	50	510	48	51	13.3	37	55
Mississippi Chemical	253	90	92	5	79	61	1.9	79	14	289	59	46	1.7	72	64
Mobil	4084	11	11	397	17	9	9.7	52	26	3265	12	12	12.2	46	10
Monsanto	5711	5	5	624	8	8	10.9	46	36	4831	7	7	12.9	41	28
Morton International	1021	50	54	140	40	39	13.7	31	38	na	—	36	na	—	42
Nalco Chemical	1212	44	48	211	29	35	17.4	20	33	1037	37	32	20.3	17	33
National Starch	1670	34	34	254	22	31	15.2	27	41	1448	27	26	17.6	21	38
NL Industries	907	58	49	251	24	25	27.7	4	4	1967	19	—	12.8	42	—
Nova	489	75	63	−17	81	—	def	81	—	221	65	—	def	74	—
Occidental Petroleum	5040	8	7	636	7	4	12.6	38	13	5494	6	6	11.6	48	21
Olin	1269	42	38	45	62	36	3.5	74	45	945	38	33	4.8	69	35
Petrolite	283	88	89	17	74	71	5.9	68	68	209	66	65	8.0	63	61
Pfizer	548	71	74	29	67	63	5.3	72	64	418	55	49	6.9	65	66
Phillips Petroleum	2120	25	20	448	12	11	21.1	10	7	1797	23	23	24.9	7	3
PPG Industries	1150	45	44	231	27	27	20.1	12	16	1076	36	31	21.5	12	13
Quaker Chemical	201	92	94	22	71	69	10.7	47	48	152	69	72	14.1	32	27
Quantum Chemical	1959	27	24	242	26	17	12.4	40	22	2235	18	19	10.8	50	19
Reichhold Chemicals	1000	51	—	na	—	—	na	—	—	na	—	—	na	—	—
Rhône-Poulenc	2278	21	32	na	—	—	na	—	—	na	—	—	na	—	—
Rohm & Haas	2824	17	18	351	18	23	12.4	40	54	2414	17	17	14.5	29	51
Sequa Corp.	201	93	—	30	66	—	14.7	28	—	112	71	—	26.5	5	—
Shell Oil	3718	12	12	519	10	7	14.0	29	11	3952	8	8	13.1	39	14
Sherex	177	94	93	na	—	—	na	—	—	na	—	—	na	—	—
Sigma-Aldrich	440	80	84	104	45	53	23.5	8	12	485	51	54	21.4	13	28
Solvay America	997	52	50	na	—	—	na	—	—	na	—	—	na	—	—
Stepan	390	84	85	21	73	77	5.5	69	75	247	63	64	8.7	59	68
Sterling Chemical	506	73	70	88	49	38	17.5	19	6	352	57	59	25.1	6	2
Sun Co.	486	76	73	na	—	—	na	—	—	na	—	—	na	—	—
Sybron	120	100	—	na	—	—	na	—	—	na	—	—	na	—	—
Tenneco	1298	41	40	167	33	44	12.9	37	60	1409	28	27	11.9	47	61
Terra Chemicals	961	56	53	na	—	—	na	—	—	na	—	—	na	—	—
Texaco	1723	32	27	60	57	19	3.5	74	16	1308	31	28	4.6	70	6
Union Camp	460	79	83	22	71	76	4.9	73	76	352	57	61	6.4	66	70
Union Carbide	7621	4	4	1033	4	5	13.6	32	38	7613	5	5	13.6	35	31
Uniroyal Chemical	808	62	60	108	44	—	13.4	33	—	1178	32	—	9.2	57	—
Unocal	1236	43	39	115	43	56	9.3	53	70	671	44	45	17.1	24	57
Vista Chemicals	719	66	62	151	38	30	20.9	11	1	na	—	47	na	—	5
Vulcan Materials	409	83	82	72	52	54	17.7	18	25	na	—	—	na	—	—
Witco	769	65	64	82	51	72	10.7	47	78	477	52	56	17.2	23	70

Note: Companies giving only net profits are not ranked. There are 81 firms ranked for operating profits and operating profit margins and 74 ranked for chemical assets and return on assets.

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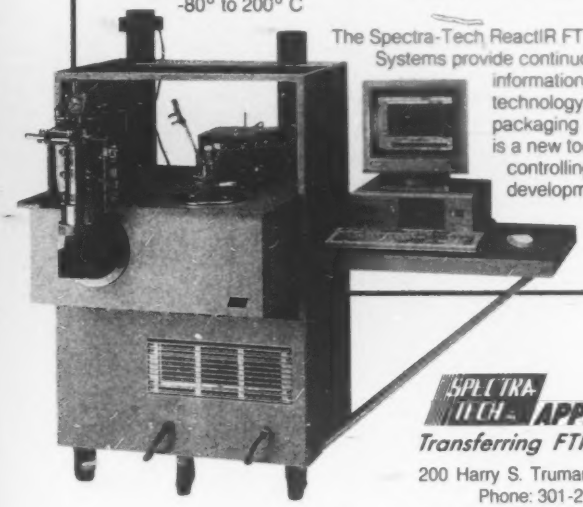

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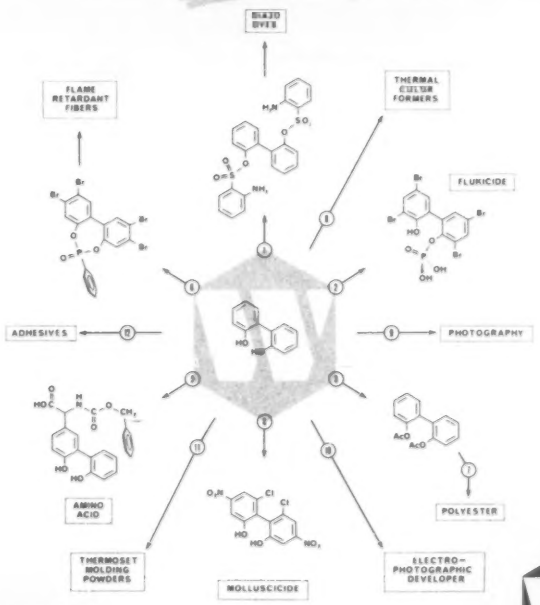

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list, accounting for about 86% of total chemical sales. This is the same percentage that this group showed in the 1989 ranking.

Firms classified as chemical companies accounted for about 41% of total sales, the same percentage as they had in the ranking for 1989. However, the remaining 59% is divided slightly differently. In the rankings for 1990 chemical sales, oil and natural gas companies account for 21% of the total, compared with 23% of the 1989 total; diversified and other firms make up 20%, down from 21%; and foreign-owned firms provide 18% of the total, up from 15%.

This mix has changed considerably in the past five years. Among the companies making up the list in 1985, the 50 largest firms accounted for just 79% of total chemical sales. And among the classifications of companies, the foreign-owned firms have more than doubled their percentage of the total to 18% in 1990 from just 8% in 1985 at the expense of two of the other groups. While the chemical group is up slightly from 39% to 41%, petroleum and gas is down from 26% in 1985 to 21% last year, and diversified and other companies' contribution has fallen from 27% to 20%.

Among the companies included in the ranking of 1990 chemical sales, there are just five firms new to the list—Reichhold Chemicals, now a part of Japan's Dainippon at number 51; Hüls, the U.S. subsidiary of the German company at 78; Sequa Corp., number 93; Aceto at number 99; and Sybron at the 100th position.

Of the five companies that dropped off the list, only one was because of a decline in chemical sales. BP America, the U.S. arm of British Petroleum and the 37th largest chemical producer for 1989, has changed its accounting methods and no longer discloses chemical sales. The U.S. arm of Switzerland's Lonza, which ranked 80th in last year's listing, also would not disclose sales for 1990.

Atlas Powder, which was in the process of being acquired by ICI from Tyler last year and was ranked 71st, has now been fully absorbed by the British chemical giant, which does not disclose U.S. chemical sales.

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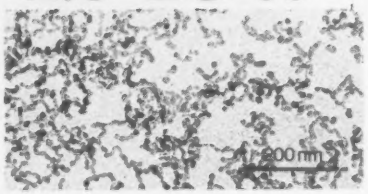

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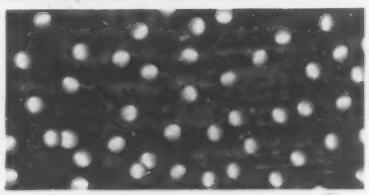

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Agway, number 100 company in 1989, also no longer discloses chemical sales. Only Nu-West, which was 96th on the listing last year, had a sales decline, which took it off the table.

There is no surprise that the number one company on the list is Du Pont. It was the largest U.S. chemical producer in last year's listing and in fact has held that position as long as C&EN has been ranking the top chemical producers.

Du Pont is followed by Dow Chemical, as it had been in 1989. However, Dow continues to make small gains on Du Pont's top spot and is now less than $1 billion behind the Wilmington, Del.-based giant in chemical sales.

Within the top 10 firms, the companies represented in the 1990 rankings are the same as in 1989. And all have maintained their positions with the exception of General Electric and Occidental Petroleum, which have exchanged positions. This year, General Electric moves up one position to seventh place and Occidental moves down one slot to eighth.

A great deal of movement took place among the Top 100 chemical producers for 1990, with 38 companies improving their rankings over 1989, 20 remaining in the same position, and 37 slipping in the rankings. The remaining five were not included in the listing last year.

The two biggest improvements in rank were by Degussa and Imcera. Degussa moved up 18 places to 38th in 1990. Imcera increased its position the same number of places to 49th from 67 for the ranking in 1989.

Other double-digit improvements were registered by Ciba-Geigy, which jumped 16 places to number 26; Great Lakes Chemical, up 13 places to number 48; Rhône-Poulenc, up 11 positions to number 21; and Loctite, up 10 places to number 69. Of the remaining companies that moved up, four improved six places; two moved up five spots; five improved by four positions; three were up three places; eight improved two places; and 10 moved up one position.

The largest decline in rank was recorded by Freeport-McMoRan, down 14 places to number 60. This was followed by Nova, down 12 places to number 75, and Georgia Gulf, down 10 places to number 57. Three companies dropped nine places; one firm down six; two down five; six off by four; five down by three and five more off by two; and 12 down one spot.

Once again, although C&EN includes all of the companies from which it can get chemical sales figures in its ranking, there are a number of firms that would be included if they were to disclose the results of their chemical operations. Chief among these are ICI and now BP, but the list also includes such publicly held U.S. firms as 3M and Procter & Gamble and some private firms such as J. M. Huber and PQ Corp.

Though sales improved for most of the companies between 1989 and 1990, they were not so fortunate in operating profits, where higher raw material and other costs and lackluster pricing took a considerable toll. Of 81 companies that report operating profits from chemical operations, 46 registered declines between 1989 and 1990.

The number one company in chemical operating profits for 1990 was Du Pont, moving up from number two in 1989. Dow Chemical is number two now, but had been number one in 1989.

Number three in chemical operating profits is Aluminum Co. of America. However, its ranking is tainted by the inclusion of a significant amount of nonchemicals into its reporting category. Union Carbide is number four and General Electric number five.

In operating profit margin (operating profits from chemicals divided by chemical sales), the number one company is Alcoa, followed in order by GAF, Lubrizol, NL Industries, and Great Lakes Chemical.

The top five companies in chemical assets, in order, are Du Pont, Dow, Exxon, General Electric, and Union Carbide. And the top five in operating return on those assets (chemical operating profit as a percentage of identifiable chemical assets) are Georgia Gulf, Alcoa, Lubrizol, American Petrofina, and Sequa Corp. □